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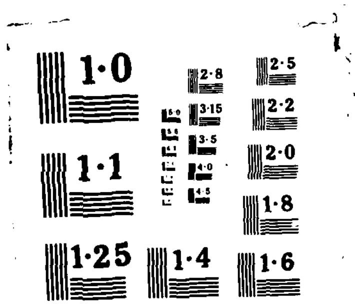
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Ocean Engineering

CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON NAVY YARD
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(1)

PROJECT DOCUMENTATION REPORT
FOR THE ST. CROIX
HYDROPHONE DEPLOYMENT TRIALS

FPO-1-84(49)

DECEMBER, 1984

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On Sept. 24, 1984 Chesapeake Division, Naval Facilities Engineering Command, Ocean Engineering & Construction Project Office conducted a series of trials of the proposed installation scenario developed for the planned expansion of the St. Croix Underwater Tracking Range. This report describes in detail the scenario.

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ABSTRACT

On 24 September 1984, Chesapeake Division, Naval Facilities Engineering Command, Ocean Engineering and Construction Project Office conducted a series of trials of the proposed installation scenario developed for the planned expansion of the St. Croix Underwater Tracking Range. This report describes in detail the successful trials of this scenario.

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RESULTS OF THE ST. CROIX HYDROPHONE DEPLOYMENT TRIALS

SECTION ONE: MANAGEMENT SUMMARY

1.0 BACKGROUND

Chesapeake Division, Naval Facilities Engineering Command (CHESNAVFACENGCOM) is providing engineering support to Naval Air Systems Command (NAVAIRSYSCOM) for the installation of an extension to the St. Croix Underwater Tracking Range (UTR). Several cables are to be installed to connect on-bottom tracking units to the shore station. Each tracking unit is to be lowered to the seafloor by the transmission cable. The units are supported off the seafloor on tripod-like hydrophone support structures (herein called structures).

This report documents the results of an at-sea trial of the proposed deployment scenario. The procedure has been described previously in the Project Execution Plan for the St. Croix Structure Deployment Test at San Clemente Island, prepared by the Ocean Engineering and Construction Project Office (FPO-1), CHESNAVFACENGCOM, reference (1). The reader is referred to this Project Execution Plan (PEP) for details of the procedure. Only field modifications to the plan will be described herein.

The test was performed under the direction of the At-Sea Operations Director assigned by FPO-1. Instrumentation support was provided by the Naval Underwater Systems Center (NUSC), Newport, R.I.

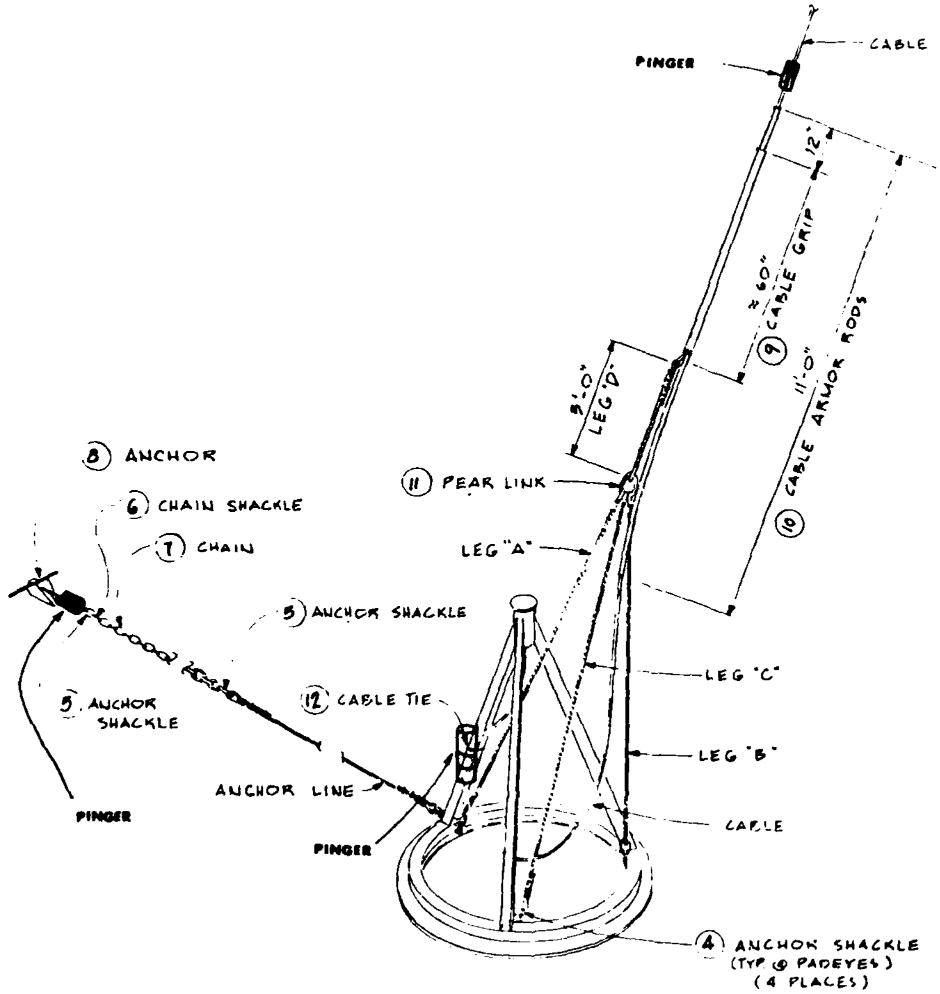
1.1 SYSTEM DESCRIPTION

The system deployed during these trials is similar to that to be installed for the St. Croix UTR expansion. Figure 1 is an isometric view of the major components of the system, minus the hydrophone, which is mounted at the apex of the structure.

The prototype hydrophone unit was provided by the Naval Research Laboratory (NRL) Orlando, FL for use during the trial deployment. Specifications for the unit were provided by NRL.

The support structure, designed by FPO-1 for ease of handling and a minimum of acoustic reflectivity, is steel with a protective coating of black coal tar epoxy. An annular PVC base plate increases the bottom contact area. The structure has a base diameter of 72 inches and a height (without the hydrophone) of 76 inches. The wet weight of the structure is approximately 400 pounds. Details are contained in NAVFAC drawings 3026166 and 3026167.

The electromechanical cable, which also acted as the lowering line, was a length of .057/.180 caged armor coaxial cable remaining



ISOMETRIC VIEW
(AT TOUCHDOWN)
NTS

Figure 1 System Configuration

in the Ocean Construction Equipment Inventory from the 1980 St. Croix UTR expansion. The cable was wound onto a reel with the shore armor out, so that the shore armor end was spliced to the hydrophone. (This cable did not mechanically duplicate the cable now being manufactured for the planned St. Croix UTR expansion. However, the characteristics of this substitute cable were used in the computer simulation of the deployment). The cable was spliced into the prototype hydrophone to provide data to monitor the deployment. Details of the monitoring system are described in a subsequent section.

The lowering sling and anchoring system were designed by FPO-1. Details are contained in NAVFAC drawing number 3026262.

1.2 DEPLOYMENT TRIAL SITE

The deployment trial was conducted in the waters off San Clemente Island, California. The site was chosen as a "location of opportunity" in that the OCP SEACON was operating in that area on an unrelated project. A position was chosen to meet several criteria. A relatively flat bottom sufficiently removed from ongoing construction, with sufficient depth to adequately model the actual installations, yet be with range of the established Mini-Ranger stations was chosen at Lat 33^{o} 01' 14" N Long 118^{o} 47' 00" W. The depth (as given on DMA chart 18XCO18740) at this point was 775 fathoms (4650 feet).

1.3 DEPLOYMENT TRIAL PLANNING SUMMARY

The trial deployment was planned to take advantage of the OCP SEACON operating schedule during a project taking place at San Clemente Island. At the completion of the at-sea portion of that project, the OCP SEACON and deck crew were made available for these trials. The PEP was issued in September 1984.

1.4 DEPLOYMENT OPERATIONS SUMMARY

The trial deployment consisted of lowering the structure near the seafloor on the electromechanical cable, dragging and imbedding the anchor, then lowering the structure at the proper ship offset, paying out cable and landing the structure with the base horizontal. Additional cable was paid out with the ship stationary to transfer the weight to the seafloor. The ship then moved to lay cable on the seafloor to ensure the stability of the implantment.

The orientation of the structure during landing and cable lay was monitored with instrumentation secured to the structure. Data were received through the prototype hydrophone wired into the electromechanical cable, which was also the lowering line.

After transiting 1000 feet down the arbitrarily chosen track line, the run was stopped and the just laid cable was retrieved. Recovery continued until the instrumentation verified the structure and anchor line were again suspended in the water column. The scenario was repeated a second time after which the entire system was recovered.

SECTION TWO: TRIAL RESULTS

2.0 GENERAL

The trials were performed on September 24, 1984 following the procedure detailed in the PEP. Deviations from the PEP are noted as necessary.

2.1 INSTRUMENTATION

Three instruments were secured to the hydrophone/structure/ lowering sling system to monitor the deployment. An InterOcean Systems, Inc., model 1090-1 15 kHz pinger with a 3 foot pennant was attached into the anchor line just above the anchor. An InterOcean Systems, Inc. model 1090-4 20 kHz pinger was secured to a leg of the structure, mounted so as to remain vertical with the structure base horizontal. In addition a Dukane Corp. model N15A253 30 kHz pinger was clamped to the cable just above the cable strain relief. Specifications for these units are described in Appendices A and B.

The prototype hydrophone mounted to the structure served as the listening device throughout the trials.

2.2 OVERBOARDING

The addition of a tensiometer between the U-frame and the cable sheave, and the presence of a cable chute at the stern necessitated lifting the structure by Liebherr Crane and transferring the load to the cable. Figure 2 shows this transfer in progress. This was done without incident. Previous overboarding trials demonstrated the ease of the intended overboarding scenario. Figure 3 shows the system just prior to the initiation of lowering.

2.3 LOWERING

With the ship station keeping at the predetermined point the system was lowered at a rate of 50 fpm. At 104 feet a first test of the instrumentation was performed. Monitoring the signal necessitated stopping the Morgan reel stand to access the bitter end of the electromechanical cable. The signal from the Dukane pinger was not being received through the hydrophone.

Figure 2 Transferring Load to Lowering Sling

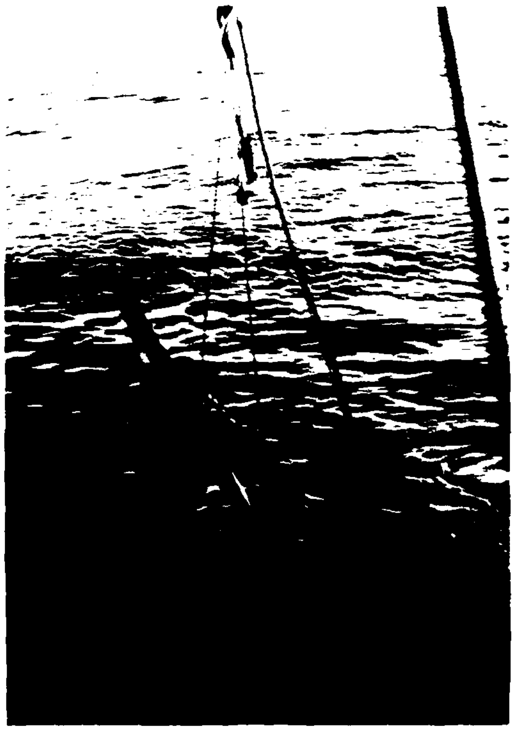


Figure 3 Initiation of Lowering

With 1000 feet of cable out the lowering was again stopped to test the instruments. The anchor and structure pingers were functioning; the Dukane pinger was not.

With 4450 feet of cable out the ping rate of the anchor-mounted pinger changed, indicating the anchor was on the bottom. (Degree of tilt is converted to ping rate; see Appendix A).

To verify this response, the W-9 cable engine hauled in slowly while instrument response was constantly monitored. The paid in cable was faked out on deck so the reel stand could remain still. With 32 feet hauled in, a change in response was noted. This corresponds to a water depth of 4546 feet (4450 of cable paid out minus 32 feet hauled in plus 128 feet of anchor line to the pinger location).

2.4 STRUCTURE TOUCHDOWN

Analysis of the touchdown scenario was done for a water depth of 4650 feet versus 4546 feet found at the anchor touchdown point. The ship's excursion versus added cable out calculations were judged adequately close for actual conditions (refer to Table 1 of reference 1).

These calculations showed an excursion of 560 feet with a cable payout of 156 feet would bring the structure to its touchdown orientation.

To control excursion distance and cable feed very carefully it was decided a staggered approach to this final position would be used. That is, the cable was lowered a predetermined amount with SEACON station keeping; then SEACON moved forward a predetermined distance without lowering the cable. This continued until the proper excursion/cable payout combination was reached. This technique obviated the impractically slow cable feed rates and ship's speeds necessary to reach this final configuration in a continuous process. In addition, this stepwise approach was needed to monitor the instrumentation during touchdown, which required stopping the reel stand revolution.

Touchdown was achieved during the first trial by following the cable payout/ship's translation schedule given here as Table 1. After anchor touchdown (the first row of Table 1) the initial 57 foot payout was made to assure sufficient anchor line was on the bottom to prevent lifting the anchor off the bottom. The remaining cable payout and the necessary translation were then divided into ten parts, with the final step being a ship's translation. This prevented overloading the anchor and dragging the system.

At each step the instrumentation was interrogated to ascertain the structure's orientation. Height off bottom was also determined,

using the direct and reflected signals from the structure mounted pinger. As the structure came within 12 feet of the bottom the return from the pinger could no longer be resolved into direct and reflected signals.

When the structure was in its final position (as determined by calculation and verified to the extent possible by available height off bottom data) the tilt sensing equipment response indicated a horizontal orientation. (Within the sensitivity of the instrument, an orientation of 0° to 10° was recorded).

To completely transfer the structure's weight to the ocean floor an additional 69 feet of cable were dumped at this position. This served to lay the lowering sling and cable on the bottom in anticipation of the cable lay. The structure maintained the correct orientation during this transfer.

TABLE 1 STRUCTURE TOUCHDOWN TEST 1

PAYOUT (FT)	TRANSLATION (FT)	TOTAL PAYOUT (FT)	TOTAL EXCURSION (FT)	INDICATED HEIGHT OFF BOTTOM (FT)	INDICATED ORIENTATION (DEGREES)
0	0	0	0	Anchor on bottom	
57	0	57	0		
0	56	57	56		
11	0	68	56		
0	56	68	112		
11	0	79	112		
0	56	79	168		
12	0	91	168		$10-25^{\circ}$
0	56	91	224		
10	0	101	224		$10-25^{\circ}$
0	56	101	280		
11	0	112	280	36	$10-25^{\circ}$
0	56	112	336		
12	0	124	336		
0	56	124	392		
10	0	134	392		
0	56	134	448		
11	0	145	448	10	$0-10^{\circ}$
0	56	145	504		
11	0	156	504		$0-10^{\circ}$
0	56	156	560		
69	0	225	560		$0-10^{\circ}$

2.5 CABLE LAY

A simple cable payout table was generated to continue the scenario into the cable lay phase. A 10 percent slack rate was included, resulting in the simple relation cable payout rate = 1.1 times vessel speed for a flat bottom. Target payouts along an arbitrary trackline were computed for a vessel speed of 0.75 knots. The cable lay was terminated with 1030 feet of cable paid out beyond anchor touchdown. The structure remained upright (within the 0^{o} to 10^{o} range) at the completion of this run.

Just beyond this length was the transformation from the stronger shore armored cable which was used to the sea armored cable. With over 4500 feet of the heavier cable in the water column, the sea armor would feel an immediate tension of greater than 60 percent of its rated breaking strength. Going beyond this transition would have introduced the risk of losing the entire deployed package. At the end of this run the cable was hauled in and rereeled until the anchor instrument indicated the anchor was again suspended in the water column.

2.6 SECOND TRIAL DEPLOYMENT

The touchdown, transfer and cable lay scenarios were repeated following rereeling. Again, the instrumentation indicated a horizontal base touchdown at the prescribed position and payout. Fewer steps were used in this case to reach this final configuration. The sequence of moves is detailed in Table 2.

Again a cable lay was begun. About 300 feet down the trackline the wire came off the W-9 winch. SEACON was brought to a stop. The structure remained upright during this incident, although it is possible the structure was dragged. The At-Sea Operations Director decided to stop the test at this point. Continuing from this point would amount to no more than restarting a cable lay.

At the conclusion of the second trial, the entire system was retrieved without incident. After retrieval no damage to any element of the system was observed. A quantity of medium stiff clay remained affixed to the anchor flukes through its ascent, indicating the anchor had set as anticipated.

2.7 TENSIOMETER RESULTS

During the first lowering to cable lay sequence the cable tension was monitored by a tensiometer mounted between the U-frame and sheave. The tension measured by the device and the corresponding tension in the cable (assuming no friction loss in the sheave) are given in Table 3. The actual values based on the static submerged weight of the components are listed for comparison. Note the good agreement between the actual submerged weight and the cable tension derived from the measured load (column 2 vs. column 4 of Table 3).

TABLE 2 STRUCTURE TOUCHDOWN TEST 2

PAYOUT (FT)	TRANSLATION (FT)	TOTAL PAYOUT (FT)	TOTAL EXCURSION (FT)	INDICATED HEIGHT OFF BOTTOM (FT)	INDICATED ORIENTATION (DEGREES)
0	0	0	0	Anchor on bottom	
68	0	68	0		
0	112	68	112		
23	0	91	112		
0	112	91	224		
21	0	112	224	25	25+
0	112	112	336	35	10-25
22	0	134	336	25	10-25
0	112	134	448		10-25
22	0	156	448		0-10
0	112	156	560		0-10
69	0	275	560		0-10

Table 3 Tensiometer Results

Cable Out (ft)	Actual Submerged(1) Weight (kips)	Measured Tension (kips)	Corresponding (2) Cable Tension (kips)
100	0.50	1.0	0.5
1001	0.96	1.8	0.9
2900	1.93	3.0 - 3.6	1.7
3900	2.44	3.9 - 4.3	2.1
4100	2.54	4.2 - 4.7	2.2
4300	2.64	4.3 - 4.7	2.3
4400	2.69	4.4 - 4.8	2.3
4418(3)	2.68	4.2 - 4.9	2.3
+ 79(4)	2.68	4.4 - 4.9	2.3
+101	2.68	4.3 - 4.8	2.3
+156	2.73	4.2 - 4.8	2.3
+225(5)	2.32	3.9 - 4.2	2.0

NOTES:
(1) Includes cable, structure, sling, anchor, instrumentation as appropriate.
(2) Assumes no losses in hardware; cable tension equals one-half the mean of the measured tension range.
(3) At anchor touchdown
(4) Payout beyond anchor touchdown
(5) Calculated payout for structure landed

3.0 ANALYSIS OF RESULTS

In each of two trials, the hydrophone support structure was successfully placed on the ocean bottom in the intended base-horizontal position. Although the bottom finding pinger placed on the cable failed, some height above bottom data was available through the structure mounted instrumentation. (The cause of the failure has not been determined).

The computer simulation used to model the touchdown scenario was revised by introducing the slightly reduced depth encountered and the stepwise sequences used during the at-sea trials. The predicted versus measured height off bottom can be compared directly. The results of this comparison are presented in Table 4.

Table 4 Predicted vs Measured Height Off Bottom

Cable Out (1) (ft)	Excursion (2) (ft)	Measured Height Off Bottom (3) (ft)	Predicted Height Off Bottom (4) (ft)
112	280	36	21
145	448	10	0
112	224	25	17
112	336	35	22
134	336	25	0.2

NOTES:

(1) Beyond anchor touchdown
(2) From anchor touchdown hold point
(3) From direct vs. reflected signal
(4) From computer simulation

The calculated height off bottom is seen to be consistently lower than that measured during the trial. This may be a result of current induced increase in cable scope or the limiting accuracy of the counter used to measure the quantity of cable paid out. (A vertical lowering was assumed).

The computer simulation using the revised depth (cable out at anchor touchdown) data predicted the "touchdown imminent" position would occur with 155 feet of payout at an excursion of 560 feet. These numbers coincide with the scenario followed to well within the accuracy of the cable counter and Mini-Ranger data used to reach this position.

The tensiometer results can be viewed as mixed. In the nearly calm seas prevalent during these trials, the loading through the heave cycle varied as much as 700 pounds, which is nearly double the load reduction resulting from transfer of the structure load to the sediment. Using mean values, however, a significant load reduction is evident after the final 69 foot cable dump (last row of Table 4). In an actual deployment depth of 15,000 feet, and with the likelihood of greater seas at the project site, the landing may not be readily discernible.

SECTION FOUR: LESSONS LEARNED

4.0 CONCLUSIONS AND RECOMMENDATIONS

It has been shown that the proposed installation scenario results in a satisfactory implantment. The stability of the system was shown during an inadvertent interruption in the cable lay when the cable worked free of the cable winch. As SEACON came to a stop a significant translation without cable payout occurred. Because of the tight tolerances specified for the landing, this excursion may have dragged the system. The structure remained upright during this incident. (The position of the system relative to the ship was not known).

For these reasons it can be concluded that instrumentation on the structure may not be necessary for the installation.

The risk of overturning, however, has certainly not be eliminated. It remains necessary to monitor the status of the hydrophone to ensure a successful mission.

Positive indication that the anchor has reached the bottom is critical to allow the subsequent blind landing to proceed as calculated. If this datum is discernible using the hydrophone alone to monitor an independent sound source, no instrumentation would be required on the anchor. The reflectivity of the bottom sediment is critical to the success of this method, as height off bottom data would be available only by measuring the time difference between direct and reflected signals. This method introduces more risk than the anchor mounted pinger method employed during these trials.

After landing, the orientation of the structure would be determined without direct indication from a structure mounted tilt sensor. This could be accomplished by careful interpretation of the return signal into an "upright" or "overturned" determination. Small degrees of tilt would go unnoticed.

4.1 INSTRUMENTATION OPTIONS

The majority of the hydrophones to be deployed at St. Croix will be implanted on the abyssal plain. One unit,however, is planned for installation on the escarpment. This more complicated landing will require more positive indication of structure orientation.

Direct acknowledgment of anchor touchdown and structure orientation were provided in these trials by instrumentation attached directly to both the anchor and the structure. Elimination of these monitoring devices should be carefully weighed against any risks introduced by its absence, and against scheduling and cost repercussions. Three possible monitoring techniques are briefly described below. Required lead times, costs and quality of data received differ significantly.

4.1.1 Minimum Instrumentation

A sound source at or near the surface can be used in determining height off bottom data. However, reflectivity, absorption and penetration of the soft bottom sediments in the construction location will affect the ability to determine accurately the anchor touchdown using just a surface source. Prudent choice of this source can minimize these handicaps. High frequency will help overcome the soft bottom problem. A narrow pulse with (approximately 1 ms) will improve the resolution of the direct and reflected signals.

A backup method, particularly for determining the critical anchor touchdown point is necessary. An anchor mounted pinger or bottom contact activated sound source would indicate positively an anchor down condition. (An event marker such as a small explosive charge would be limited to a single use. This would disable the backup system if it becomes necessary to pull up and reset the anchor). The landing scenario could proceed using returns from the surface source.

Sound sources of this type are available and should require no development time.

4.1.2 Direct Mounting of Touchdown and Orientation Instruments

The structure mounted pinger used in the trials could be slightly modified to provide the necessary data, but eliminate the balance and reflectivity problems associated with its use.

A structure mounted instrument should be nearly neutrally buoyant. It was shown during a land based stability investigation that just before transfer of the structure's load to the sediment a very small force (perhaps two pounds) could orient the base to the horizontal. Such a delicate balance is necessary to prevent overburdening the weak sediments to be encountered. Near neutral buoyancy would maintain the design center of gravity of the lowering sling/structure system. The desired buoyancy could be attained using a molded foam collar, which would also fix the orientation of the device relative to the structure.

Reflectivity can be eliminated by using soluble connectors to mount the instrument to a leg of the structure. A slightly positive net force would allow the device to harmlessly drift away from the structure after a predetermined period.

The pinger should be reworked to concentrate its energy downward to enhance the reflected signals and thus improve height off bottom data. Reduced pulse width would also improve the resolution of the height off bottom data.

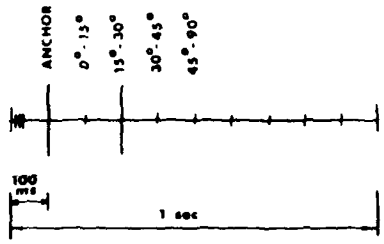
An anchor mounted pinger could be used in a configuration unchanged from the trials. The operating life of both devices should be limited to no more than three days to avoid interference among the multitude of units to be deployed at St. Croix.

Equipment of this nature is not an "off the shelf" item. The development of these electronics should be tasked to an activity with in-house abilities in this field, or procured through contract. It is estimated that development of such a package would require approximately 4 months of effort after the appropriate specifications are prepared and contracts negotiated. The contracting, development and production of the system must be started during the second quarter of FY 1985 to assure timely delivery.

4.1.3 Remote Sensing Package

Given sufficient lead time, an instrumentation package which eliminates the reflectivity and balance problems associated with the package used in these trials can be developed. The solution lies in minimizing the size of any device added to the structure/lowering sling system--elements secured to the anchor and/or the lowering line (cable) do not significantly alter the proposed installation scenario.

One such concept is illustrated in figure 4A. A small tilt sensor is secured to the base of the structure and wired into a deep water acoustic pinger mounted on the electromechanical cable above



RETURN SIGNAL CONCEPT

Triple Hash Mark at Time = 0
Signal at 100ms = Anchor Down
Signal at 300ms = 15°-30° Structure Tilt

Figure 4B

LEGEND:

1. Anchor Touchdown Sensor
2. Structure Tilt Sensor
3. Remote Pinger (wired into 1 and 2)

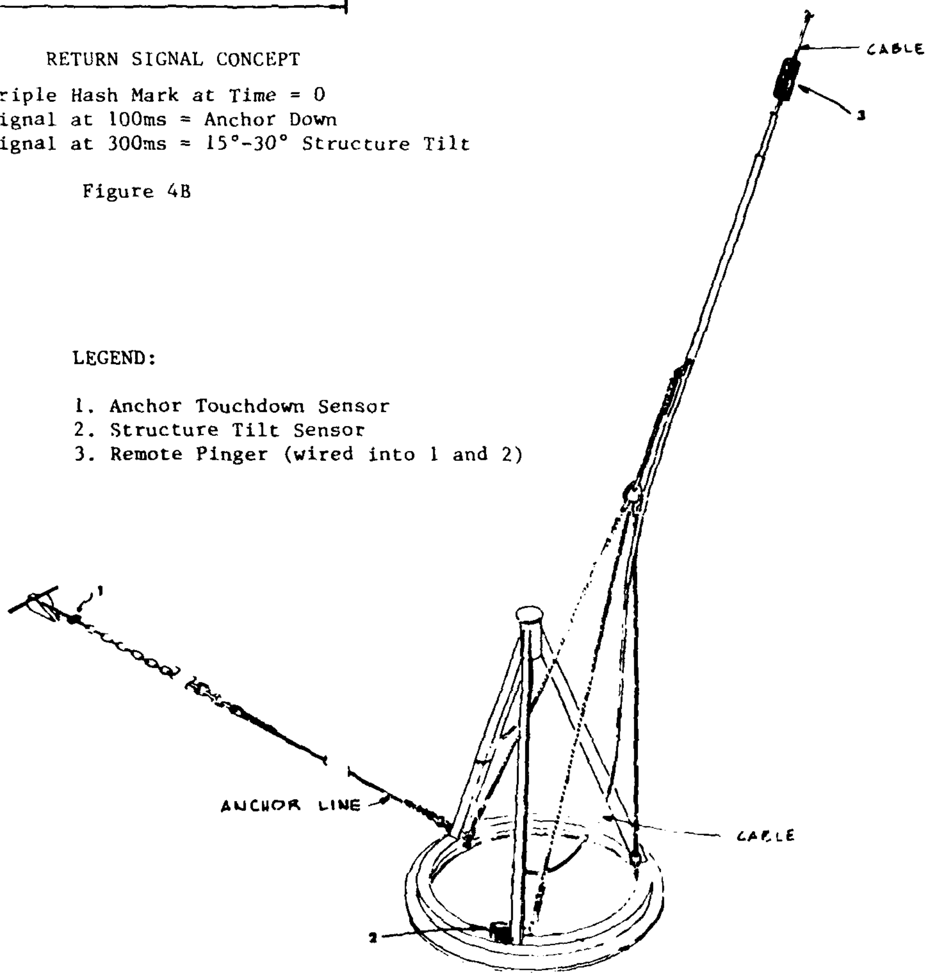


Figure 4A. Instrumentation Concept

the lowering sling. A second sensor is mounted on the anchor and wired back into the pinger. The parameters used below are arbitrary in nature and chosen to illustrate the concept.

During lowering, a one pulse per second (pps) record is recorded. Height off bottom data can be obtained from this record. Anchor touchdown and set initiates a signal from the anchor mounted sensor, recorded at the 100 ms interval of the one second cycle. Should the anchor lift off the bottom this signal shuts down. A record on the interval from 200 ms to 500 ms initiates when the structure hits bottom. The tilt angle is ascertained by the position of the signal on the record. For example, the 200 ms position indicates a 0° to 15° tilt, the 300 ms position indicates a 15° to 30° tilt, etc. A typical record of the signal received by such a system is shown in figure 4B.

This alternative provides continuous monitoring of the installation. Development and production lead time and costs would be the highest of the options described above. The risk of development or delivery problems becoming the driving force of overall project planning may preclude this concept entirely.

4.1.4 Instrumentation Recommendations

Use of a properly sized sound source monitored through the hydrophone, with an anchor mounted backup offers the best compromise between scheduling commitments and risks involved. Minimal additional hardware is required, and is placed at distance from the hydrophone.

The hydrophone to be implanted on the escarpment requires more careful monitoring. Use of the pingers procured for these trials, with modifications as described in section 4.1.2, should be considered.

The tensiometer used in this trial provided an indication that the structure's weight was transferred to the bottom sediment. Incorporating the tensiometer into the St. Croix Expansion PEP is recommended.

APPENDIX A

INSTRUMENTATION SPECIFICATIONS

FOR

INTEROCEAN DEEP ACOUSTIC PINGERS

MODEL 1090-1/1090-4

1.0 INTRODUCTION

1.1 General Description

The InterOcean Deep Acoustic Pinger provides reliable, acoustic information as to the location and inclination of underwater equipment.

Two models provide different information as to the location and inclination of the underwater equipment.

The 1090-1 is a 15 kHz Pinger. The ping rate changes for an inclination of greater than 45° to the vertical.

The 1090-4 is a 20 kHz Pinger. The ping rate changes for an inclination of greater than 10° and also further changes when the inclination exceeds 25° to the vertical.

Both units are of the deep (8,000 meter) mechanical configuration.

The intended operational life of both Pingers is 3 days from activation.

MODEL 1090-1/1090-4

1.2 Specifications - Electronic and Acoustic

1.2.1 Operating Temperature Range: −10°C to +50°C

1.2.2 Pinger Output:

Pulse Length	3.9 ± 0.2 milliseconds
Source Level	Better than 80db re 1 ubar at 1 yard
1090-1 Ping Frequency	15.10 kHz ± 1%
1090-4 Ping Frequency	20.00 kHz ± 1%

1.2.3 Ping Rate:

UNIT	INCLINATION	RATE
1090-1	0° - 45°	1 ping/second
1090-1	45° and above	2 pings/second
1090-4	0° - 10°	2 pings/second
1090-4	10° - 25°	1 ping/second
1090-4	25° and above	1 ping/2 seconds

All angles with reference to a vertical axis.
All angles accurate to ± 4°.

1.2.4 Battery:

Sealed Alkaline Pack
Battey Pack Life: 4 days ± 1 day

MODEL 1090-1/1090-4

1.3 Specifications - Mechanical

1.3.1 Model 1090-1/1090-4 Depth Limit: 8,000 Meters

Dimensions:	18" x 6.5" (46 cm x 16.5 cm)
Weight in Air:	36 lbs (16.34 kgs)
Material:	7075-T6 AL alloy, hard anodized, epoxy painted

APPENDIX B

INSTRUMENTATION SPECIFICATIONS

FOR

DUKANE UNDERWATER ACOUSTIC BEACON

DUKANE CERTIFICATION AND TEST DATA
UNDERWATER ACOUSTIC BEACON MODEL N15A253

CUSTOMER: Tracor Marine
P.O. Box 13107
Port Everglades, FL 33316

DATE 8-30-84 QUANTITY 2
CUSTOMER P.O. 58116-TL
SALES ORDER NO. 43246

This is to certify that the parts furnished on the above order have been fabricated and inspected to the applicable Dukane drawings and specifications and are produced from materials for which Dukane or supplier has chemical and/or physical test reports or other evidence of compliance on file.

Dukane Corporation, SeaCom Division per

Operations Manager

SER. NO.	ACOUSTIC OUTPUT	FREQUENCY kHz	PULSE DURATION (MS)	PULSE REPETITION RATE (PPS)
C8107	170.14 dB	30.1	9.5	112 sec.
C8108	170.09 dB	30.2	10.1	112 sec.

All data taken with beacons operating in water under essentially free field conditions. Acoustic output shown above in dynes/cm^2 RMS pressure at 1 meter averaged over 360° rotation.

Form No. [illegible]

APPENDIX C

LOG OF DEPLOYMENT TRIAL ACTIVITIES

The PEP for these trials was issued in September 1984. Mobilization for the trials was completed in conjunction with mobilization for an unrelated project. At the conclusion of the at-sea portion of that project the deck of the OCP SEACON was prepared for this operation. All activities logged below occurred on September 24, 1984 and are given in Pacific Daylight Time.

0600 Input arbitrary tracklines to Mini-Ranger System; prepared charts of cable payout versus position.

0700 Meeting of involved hands (At-Sea Operations Director, Project Engineer, equipment operators, UCT-TWO APOIC, Instrumentation Engineer) to lay out procedure.

0730 Deck force configured deck as per PEP; cable reel placed in position; sheave mounted from U-frame.

0900 Pre-wired hydrophone and structure moved to stern; lowering sling assembled.

0945 Instrumentation secured to system.

1035 Lifted structure and transferred load to cable.

1049 Cable counter reset with structure base at water surface.

1052 Held at 104 feet for instrumentation check.

1119 Held at 1001 feet for instrumentation check.

1145 Welded padeye onto deck for proper fairleading of cable between Morgan reel stand and W-9 cable engine.

1208 Lowered to 2000 feet.

1230 Lowered to 4000 feet.

1251 Lowered to 4450 feet; anchor down; reset cable counter. Retrieve 32 feet of cable to point where anchor mounted instrument shifts ping rate, indicating actual point of touchdown.

1305 Began structure touchdown scenario by paying out 57 feet of cable.

1311 Began excursion down arbitrary trackline. Payout and excursion schedule are in Table 1 in main body of text.

1417 Completed payout and offset maneuver.

1430 Dumped 69 feet of cable to attain transfer of weight to seafloor.

1442 Began cable lay.

1458 Ended cable lay 1030 feet down track.

1510 Began retrieval.

1545 Ended retrieval with anchor resuspended in water column.

1600 Began second trial deployment.

1612 Anchor touchdown indicated.

1617 Begin second payout and excursion schedule given as Table 2 in main body of text.

1653 Completed payout and excursion.

1656 Dumped 119 feet of cable to transfer weight to seafloor.

1702 Began second cable lay.

1710 Ended cable lay.

1720 Began retrieval of system.

1900 Structure recovered; trial complete.

END

DATE

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